

THREE CASES OF LIGATURE OF THE EXTERNAL
CAROTID ARTERY, IN TWO OF WHICH
BOTH VESSELS WERE TIED
SIMULTANEOUSLY.

WITH REMARKS ON THE HISTORY OF THE OPERATION.¹

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I THINK it to be both proper and essential to recall, in connection with these cases, something of the early history of the operation, even at the risk of adding burdensome details to a subject that has so recently been considered by the members of this society.

The first case, of which a definite record can be found, was operated on by M. Gensoul, at the Hotel Dieu, September 20, 1824, while he was engaged in the removal of the parotid gland for malignant disease. There is no reason to believe that he, at that time, considered the ligature of this vessel as one of the steps to extirpation of the parotid gland. It appears, rather, that the vessel was tied during the course of the operation, without this step having been considered as a special preparatory measure. I think it safe to assume, in view of the relation of the parotid gland to this vessel, that the surgeon who extirpated the gland first was the one who first tied the external carotid artery. To Beclard belongs the credit of having furnished the first reliable account of the removal of this gland, which he himself removed in 1823. M. Gensoul repeated the operation.

The surgeon who first tied the external carotid as a preparatory measure, of which a definite record can be found, was

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George Bushe, of the Royal College of Surgeons of Ireland. It was performed in a little patient of about ten and a half years of age, to check a severe hæmorrhage following the removal of a pulsating nævus from the temporal region. The removal was not attempted, however, until all other recognized expedients had failed. The little patient made a rapid and satisfactory recovery, which pleased the operator so much that he expressed himself as follows:

"I shall trust in the future to ligature of the external carotid in such cases, and here I may say that, where the disease is not in the orbit, I cannot see the necessity of securing the common carotid for anastomosing aneurism of the face and head."

In connection with the remarks just quoted, I will call attention to the history of the first of the three cases operated on by myself.

The patient was admitted to the Bellevue Hospital August 1, 1883, æt. 24, family and personal histories good. About six months before admission he was struck in front of the left ear with a bottle, which was broken by the force of the blow. The wound of the scalp healed quickly under simple dressing. A short time thereafter a pulsating tumor appeared at the seat of injury, which increased in size continuously until the date of admission. On admission a well-defined pulsating tumor was found at the seat of injury, of about the size of a hen's egg, which had a distinct thrill and bruit. The trunk of the temporal artery, together with the anterior and posterior branches, was involved directly in the growth. The trunk of the occipital artery of the same side was dilated, and its anastomotic communications with the branches of the temporal were dilated also. The patient was kept under observation for a few days to study the peculiarities the tumor might present, but inasmuch as its chief feature consisted in its rapid development, it was decided to tie the external carotid artery of the same side with a view to arrest the growth, if not to effect a cure.

On August 7, 1883, the vessel was tied in the presence of many of the visiting and resident staff of the hospital. It was exposed in the usual manner for about an inch above the point of bifurcation. The lingual branch arose about half an inch above that point, and it was tied at once with an independent catgut ligature. After this the trunk of the external carotid was tied with catgut at the origin of the already

ligatured lingual branch. The previous tying of the lingual had provided a branchless portion of the external carotid of about an inch in extent. The ascending pharyngeal branches were sought for, but were not found. Nothing unusual was noticed during the operation, except that the internal jugular vein overlapped the external carotid at the seat of ligaturing. The ligaturing of the external carotid checked the pulsation and all other aneurismal manifestations of the growth at once, also reduced its size to about one-third of the previous dimensions.

The operation was done antiseptically throughout, and the wound had healed entirely at the end of ten days, when the first dressing was removed. At this time a slight returning pulsation could be detected in the tumor, which, however, could be controlled completely by pressure on the external carotid of the right side. On August 30, the pulsations had increased, and the thrill and bruit were again noticeable. On September 8, the pulsation, the thrill, and bruit were nearly as strong as before the operation, but they could be controlled readily by pressure made on the occipital and temporal branches of the external carotid of the right side. The temporal branch only of the external carotid of the left side gave any evidence of a return of the circulation. It then became a question of tying the external carotid of the right side, or of tying its temporal and occipital branches alone, or to attack the growth itself directly. The latter plan was chosen, and was carried into effect September 26, only about seven weeks after the primary operation.

I trust that I may be excused if I digress somewhat at this time to describe the details of the method that was adopted for the radical cure of this case. The head was surrounded by two strong rubber bands, beneath which compresses were placed at the points where arteries passed to supply the scalp. By this means the arterial circulation of the scalp was controlled admirably. The growth was then nearly circumscribed just outside of its limits by a U-shaped incision, made through the healthy tissue of the scalp, down to the bone. The stem of the flap was made about an inch and a half in width, and it extended down to the zygoma, and the centre of its long axis corresponded to the course of the temporal artery. The loss of blood was not severe, since a bleeding point could be readily controlled by pressing the vessel against the underlying skull, while its open extremity was being secured. The bleeding points were closed by catgut applied directly to them when possible. If this could not be accomplished, they were closed by the overhand continuous suture of the catgut carried around and through the borders of the divided tissues. The flap and the surface from which it had been raised were kept separated

with antiseptic gauze until granulation took place; then they were fastened in apposition by adhesive straps. They united quickly, and a permanent cure resulted one month after the operation.

The following interesting practical facts are presented by this case:

1. The ligaturing of the external carotid of one side had but a temporary effect on a vascular growth that involved the branches of the ligatured vessel.
2. Pressure on the branches of the opposite external carotid artery interrupted the characteristic aneurismal manifestations that were present in the growth at its recurrence.
3. The ligaturing of all the vessels that passed to the growth, except the one of the pedicle of the flap, followed by independent granulation of the surfaces and their subsequent union, resulted in a rapid and complete cure.

I find eight additional cases of ligature of the external carotid for the cure of aneurismal tumors of the head, face, and parotid gland, in two of which both vessels were tied simultaneously. The latter procedure is not reported to have been successful in either instance. Traumatic aneurism of the parotid gland, varicose aneurism of the ear (two cases) are reported to have been cured by ligaturing the external carotid of the diseased side. It appears, however, that the last two cases received other and decided local treatment, which might have had quite as much to do with the cure as the ligaturing of the external carotid. This fact is emphasized by the recollection of the unsuccessful cases just mentioned of a practically similar nature, in which ligature of both external carotids alone failed to effect a cure. Of a total of nine cases, but one, traumatic aneurism of the parotid, was cured by ligature alone. These facts force the conclusion that ligaturing of the external carotid of the diseased side, and even of both external carotids, can be considered only as palliative, and cannot be recommended as a means of cure for vascular growths of the head and face, except in connection with other measures.

I do not think it to be a justifiable step to ligature the common carotid alone, nor in connection with ligature of the external or internal carotid for cases like the preceding, since the

rate of mortality for ligature of the common carotid is 40 per cent., while that for ligature of the external carotid is 3.62 per cent. This opinion is expressed notwithstanding the fact that the rate of cure for non-orbital anastomotic aneurismal formations is reported by Dr. Wyeth at 28 $\frac{1}{2}$ per cent., from ligature of the external carotid. It seems to me from these facts that some errors must exist in the primary reports of these cases, since the reverse of these figures would be more consonant with the anatomical bearings of the collateral circulation of the two operations.

Ligature of the common carotid should not be entertained except when from the contiguity of the morbid process the application of a ligature to the external carotid becomes impossible, or when ligature of the external carotid has failed to afford its possible relief, a contingency that is to be anticipated only when the morbid growth is developed at the location of a free anastomosis of the branches of the external carotid and the intracranial circulation, as in intraorbital formations especially.

The second authentic ligaturing of the external carotid, as a preparatory measure, was practised by John Lizars in 1830. It was done to lessen the hemorrhage attendant on removal of the superior maxilla. Preparatory ligature of the external carotid for removal of the superior maxilla, is not necessary for the safety of the patient, except in such cases as, when the patient is ill able to withstand the loss of blood that ordinarily attends this procedure; or to bear the loss that may arise from the removal of the morbid growth that prompted the operation. I am certain, however, that ligature of both external carotids and their ascending pharyngeal branches prior to the removal of large vascular growths involving the superior maxilla and the pharynx, or retro-pharyngeal growths of a similar nature, requiring the preliminary removal of the superior maxilla, should be earnestly commended to the profession. If the growth be of a malignant nature, this plan will not only lessen the hemorrhage attendant on its removal, but may likewise delay the return by lessening the activity of the nutritive processes at its site.

The third case of preparatory ligature of this vessel was

performed by Dr. Valentine Mott, about the year 1831, for extirpation of the parotid gland. The swelling of the soft parts contiguous to the diseased gland, complicated the operation somewhat; still, the patient suffered no ill effects from it, but died in less than two months thereafter from a return of the disease.

The rate of mortality of ligation of the common carotid for reputed malignant disease of the parotid gland, antrum, and face (not of orbit), is, according to conclusions of Dr. Wyeth, 44 per cent. from the operation alone, with 15 per cent. of cures resulting therefrom. I have collected nineteen instances of ligation of the external carotid for so-called malignant growths located in practically similar situations, with the loss of but one patient, who died of hemorrhage caused by sloughing of the growth. This case will be fully reported in the course of this paper.

Twenty-six per cent. of these so-called malignant growths are reported as "cured" by ligation of the common carotid. This seems inconsistent in view of the nature of the disease, a fact that was appreciated by Dr. Wyeth when he collected them. It is fair to assume, however, that if ligation of the common carotid will cure malignant disease of the face, ligation of the external carotid should lead also to a similar result. If the idea be to starve a growth, then truly, from anatomical reasons alone, ligation of the external carotid is the far more rational measure; because if the external carotid be ligatured, but comparatively little blood can reach the diseased part except by way of the opposite external carotid, provided there be no unusual anastomosis of the ligatured vessel. If the common carotid be tied for disease associated with the branches of the external carotid of the same side, then blood can reach the diseased part, not only through the opposite external carotid, but also by way of the circle of Willis, and the pervious internal trunk of the ligatured vessel.

With a full knowledge of these anatomical facts, and with the great difference in the death-rate of the respective operations, I fail to find an excuse even for ligaturing the common carotid for disease of the region supplied by the branches of the external carotid, except when ligation of the latter vessel is impracticable.

I will now present for consideration the history of two cases of my own, in each of which the external carotids were tied simultaneously for malignant disease involving the inferior maxilla, the floor of the mouth, and more or less of the tongue. In each of these cases repeated operations had been performed for the removal of the disease. A rapid recurrence had taken place in each instance, until the direct application of the knife seemed no longer feasible. The starvation plan appeared to be then the only one to offer any chance for delay to the course of the growth, combined with the greatest degree of comfort for the patients.

Recalling the fact that in the aneurismal growth, upon which I had previously operated, the collateral circulation from the opposite external carotid had reëstablished the circulation of the ligatured side within two months, and believing that it would likewise exercise the same influence in a similar operation for malignant disease, it was determined to tie both external carotids simultaneously, which was done in the first case on February 2, 1885. The incisions for ligaturing were made in the usual situations, and the enlarged lymphatic glands that were found in their course were removed. When the carotids were reached, most unusual anomalies were found. The right common carotid bifurcated beneath the posterior belly of the digastric muscle, which was divided to admit of the more easy application of the ligature. On the left side the bifurcation was located behind the hypoglossal nerve, which was drawn down and then the ligature was applied just below the posterior belly of the digastric. On the right side the superior thyroid branch was thought to be seen to arise from its usual position. No branches were found above the point of bifurcation for the distance of one inch, and a catgut ligature was applied at the middle of this space. The lingual and facial branches were not seen on the right side, a fact that caused no apprehension, for I had been informed that the facial had been tied some months before, during the removal of the diseased submaxillary gland of that side. I thought also that the lingual might have been associated with the facial since this arrangement exists in about 25% of dissections. On the left side the branches of the external carotid were normally arranged. The lingual was ligatured at its origin, and the trunk of the external carotid was ligatured just below this.

No annoyance took place during the operation other than that due

to the slipping off of a catgut ligature from the proximal extremity of the purposely divided facial vein, that had covered the artery in the line of the operation. The operation was done antiseptically throughout. The malignant growth diminished in size rapidly; the pain ceased; the discharge became scanty, thin and watery, and the ability to speak and to swallow improved rapidly. On the fifth day a portion of the tumor on the right side, corresponding to the former site of the submaxillary gland, sloughed out, leaving an opening an inch in diameter, bounded by sloughing tissue, at the bottom which could be seen necrosed bone of the lower jaw. It had been ordered that the patient be constantly watched from a fear that hæmorrhage might occur. On the night of the 11th, nine days after the operation, the patient was discovered deluged with blood, and he died from its loss before morning, in spite of every possible effort of Dr. Pinkerton, the house surgeon. Even transfusion with saline solution was employed.

It was found that the hæmorrhage had taken place from the site of the slough before mentioned. An abnormality of the circulation was suspected at once, and the suspicion was confirmed subsequently by a careful dissection. The facial and lingual branches of the right side arose from a common trunk at the bifurcation. The fatal hæmorrhage had been caused by sloughing of some of the starved diseased tissue, into which the stump of the abnormal facial artery had passed. The vessels on the left side were not uncommon in their arrangement. The operation-wounds themselves presented no appearances of an unusual character.

It is seen at once that this case presents very rare anomalies of the circulation. It is very rare indeed that the common carotid arteries do not bifurcate at or between the upper border of the thyroid cartilage and the greater cornu of the hyoid bone. I can find no record of the lingual or facial ever having arisen from a similar point, as in the above case. Dr. Wyeth, in his report of 121 consecutive dissections of the external carotid and its branches, found but four instances in which the lingual branch was given off at a fourth of an inch above the bifurcation, and in only one of these did it arise independently of the facial branch. In one instance it arose an eighth of an inch above the bifurcation by an independent origin. The average origin of the lingual in 121 cases was $0.68\frac{1}{2}$ inch above the bifurcation. In these same dissections the facial arose at

an average of 0.92+ inch above the point of bifurcation. In no instance did it arise independently within less than a fourth of an inch from this point. In one instance only the lingual and facial arose by a common trunk an eighth of an inch from the bifurcation. I have no doubt that if I had tied the branch at the bifurcation which I had supposed to be the superior thyroid, but which was, in fact, the common trunk of the facial and lingual, the patient would not have died from hæmorrhage.

The result of this case emphasizes some important facts, viz :

1. The tying of the external carotids robbed the growth of so much of its vitality that, notwithstanding it was presumably supplied in part by the lingual of the right side, and also by branches of the pervious stump of the facial of the same side, the diseased tissue sloughed and involved thereby the stump of the facial itself.

2. The branches at the bifurcation should be tied when it appears that neither the lingual nor the facial arise from the first inch and a half of the external carotid.

3. The feasibility of simultaneous ligature of both external carotids for the starvation of malignant growths of the regions supplied by their branches, is emphasized by the effects on the growth in this case.

The number of deaths from ligature of the external carotid alone that may be justly attributed to the operation itself, is somewhat indefinite. Dr. Wyeth reports 67 cases of ligaturing, with two deaths occurring after the operation ; but, inasmuch as these two patients were still suffering at the time of their death from the gunshot wounds for which the operation had been performed, it is certainly not proper to charge these deaths to the operation alone. I am able to add to this list 16 others, and in but one of these (my own) did the subsequent death of any bear the least relation whatever to the operation itself.

The amount of objection that may be raised to ligature of the external carotid by reason of the death just reported—a death clearly dependent on abnormalities of the circulation not before described—is a matter that I will leave to others

than myself to express. Hæmorrhage at the seat of the operation has never as yet proved fatal, and it has, as a rule, been controlled easily by simple means, as pressure, styptics; etc. In a number of instances hæmorrhage has taken place at the seat of the injury or of the disease, for the relief of which the vessel was tied, and it has required ligaturing of the common or internal carotid of the same side to control it. But in no instance can I find that the opposite external carotid has been tied with the same view.

The second case was performed in Bellevue Hospital May 10, 1885. It pursued subsequently in all important respects, a similar course to the first, except that no hæmorrhage or sloughing occurred. The patient was discharged from the hospital in one month, much improved, with instructions to report at intervals of a week. He reported at the hospital as requested for the next two months. During this time the growth showed but a little tendency to increase in size. The pain and difficulty in swallowing did not return. However in the meantime he had developed a profound cancerous cachexia, attended with emaciation and loss of strength. No evidences of internal cancerous involvement were discovered. Finally he disappeared suddenly, and was not again heard from by myself, even though his recorded address was visited and a thorough inquiry was made to ascertain his whereabouts.

The main objections that are raised against ligaturing the external carotid are the following: (1) The difficulty of the operation; (2) the danger of secondary hæmorrhage at the seat of the ligature. It is no doubt true that ligature of the external carotid is not as easily accomplished as that of the common trunk, but this is no reason why it should not be practised in preference to the latter when the comparative results of the two are considered. The linear guides of the two vessels are equally simple. The primary incisions of both are alike uncomplicated, provided the region of the external carotid is not invaded by disease. The deep guides of the external are as plain and unvarying as can be wished. The digastric muscle and the hypoglossal nerve are constant in their relations to this vessel. The lingual vein, the facial vein, and its connections, are obstacles to ligaturing of the external

carotid; but, with care, they can be displaced, or they may be divided between two ligatures, and turned aside. The internal jugular vein sometimes encroaches alike on both vessels. The external carotid may be mistaken for the common, as for the internal carotid. The points of origin, size, and direction of the branches of the external should enable the distinction between it and the common trunk to be easily made. The difference in the origin, course and depth of the two vessels, to say nothing of their differences as to branches, should discriminate between the internal and external carotids. Finally, if a doubt exists after the ligature is passed, raise the vessel gently from its bed by means of the ligature, and study the effects of the ligature pressure on the branches of the external carotid, and on the trunk of the internal carotid.

Care should be taken not to pass the ligature around both vessels at the bifurcation. This is an error to which the relations and appearances of the vessels in this situation add but little that is reassuring. However, to state the liability of the error should be to signal the danger with sufficient acuteness to prevent its occurrence. It is proper to add in this connection that if ligature of the external carotid be associated with removal of the parotid gland, it should be ligatured as near to the gland as circumstances will permit.

In conclusion I respectfully submit the following propositions:

1. Ligature of the external carotid artery, together with independent ligature of the branches arising from the first inch of its course, is a safe and commendable operation.
2. When the facial and lingual arteries do not arise singly, or by a common trunk from the first inch of the course of the external carotid, the branches arising at the point of bifurcation of the common carotids should be tied.
3. Simultaneous ligature of both external carotids is a rational preparatory measure for operation involving the parts supplied by their branches when dangerous hæmorrhage is feared. If the pharynx be involved, the ascending pharyngeal branches should be ligatured also.
4. Simultaneous ligature is advisable as a final expedient to diminish the rapidity of the development of extensive malignant

growths when they are nourished by the branches of the external carotids.

5. Ligature of one or both of the external carotids for the cure of aneurismal formations of the branches of the same is not feasible as an independent curative measure.

6. Ligature of the common carotid should not be done for the cure or for the arrest of morbid conditions involving the external carotid or its branches, except as a final resort.

REPORT OF OPERATION FOR REMOVAL
OF COLOSSAL CYSTIC TUMOR OF
LOWER JAW.

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AS long ago as 1871, before I even contemplated making medicine my profession, I recall the visits of Henry Macklin, to my father's office, and, that there I saw my father open a cyst about the center of the alveolar process of the lower jaw, and at intervals of several days, inject the cavity with tr. iodine. Macklin continued under treatment several months, but declined to allow any operation further than that named above. The cyst at time of first opening contained a mucilaginous fluid to the amount of about half an ounce. It seems that he sought no further advice concerning the growth, until about the first of February, 1886, when he called on me. The accompanying cut gives his appearance. His age is forty years; has resided in Memphis for twenty odd years; general health always good; occupation, teamster. Within the past six or eight months has lost flesh, owing to inability to take sufficient nourishment. Diet: Liquids and finely-cut meats. Teeth of lower jaw nearly all out, and the remaining few so diverged from the normal line that they cannot touch the upper teeth, and in fact, no effort at mastication can be made,